

What is claimed is:

1. A hardening processing apparatus for heating a substrate coated with a coating solution to harden a coating film on the substrate, comprising:

5 a first processing chamber for mounting the substrate coated with the coating solution on a heating plate and heating the substrate to a predetermined temperature on a one-by-one basis;

a first irradiation unit provided in said first processing chamber, for irradiating the substrate mounted on said heating plate with ultraviolet light; and

10 a second processing chamber connected in a communicating manner to said first processing chamber, for mounting the substrate coated with the coating solution on a temperature adjusting plate and adjusting the substrate to a temperature lower than a processing temperature of hardening processing on a one-by-one basis.

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2. The hardening processing apparatus as set forth in claim 1, wherein the substrate is heated by said heating plate while being irradiated with the ultraviolet light by said first irradiation unit so that the coating film on the substrate is hardened.

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3. The hardening processing apparatus as set forth in claim 1, wherein said temperature adjusting plate is movable between a position above said heating plate in said first processing chamber and said second processing chamber.

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4. The hardening processing apparatus as set forth in claim 2, wherein

after the substrate mounted on said heating plate is raised by a raising and lowering member, said temperature adjusting plate entering a gap between the substrate and said heating plate, and subsequently the raising and lowering member is lowered so that the substrate is transferred from said heating plate to said temperature adjusting plate.

5. The hardening processing apparatus as set forth in claim 1, wherein a passing port for said temperature adjusting plate formed between said first processing chamber and said second processing chamber is provided with a shutter for opening and closing the passing port.

6. The hardening processing apparatus as set forth in claim 1, further comprising:

a control section for performing, in said first processing chamber:  
heating processing of mounting the substrate coated with the coating solution on said heating plate and heating the substrate at a first temperature; and

hardening processing of subsequently heating the substrate, for which the heating processing has been performed, kept mounted on said heating plate at a temperature of the hardening processing that is higher than the first temperature, and irradiating the substrate with the ultraviolet light to harden the coating film on the substrate.

7. The hardening processing apparatus as set forth in claim 1, further comprising:

a control section for performing:

heating processing of mounting the substrate coated with the coating solution on said temperature adjusting plate and heating the substrate at a first temperature in said second processing chamber; and

5       hardening processing of mounting the substrate, for which the heating processing has been performed, on said heating plate and heating the substrate at a temperature of the hardening processing that is higher than the first temperature, and irradiating the substrate with the ultraviolet light to harden the coating film on the substrate in said first processing chamber.

10     8.       The hardening processing apparatus as set forth in claim 1, further comprising:

          a second irradiation unit for irradiating the substrate with the hardened coating film, with ultraviolet light having a wavelength different from that of said first irradiation unit.

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9.       The hardening processing apparatus as set forth in claim 8, wherein said second irradiation unit is provided in said second processing chamber and irradiates the substrate mounted on said temperature adjusting plate with ultraviolet light having a predetermined wavelength.

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10.      The hardening processing apparatus as set forth in claim 1, further comprising:

          an inert gas supply unit for supplying an inert gas to said first processing chamber and said second processing chamber; and an exhaust unit  
25   for exhausting said first processing chamber and said second processing chamber.

11. The hardening processing apparatus as set forth in claim 1, wherein  
the coating film is an insulating film, and the ultraviolet light applied  
from said first irradiation unit to the substrate is ultraviolet light having a  
5 wavelength of 300 nm to 400 nm.
12. The hardening processing apparatus as set forth in claim 6, wherein  
the coating film is an insulating film, and the heating processing is  
low oxygen heating processing of heating the substrate in a low oxygen  
10 atmosphere to cause condensation polymerization reaction of the coating film  
to thereby chemically harden the coating film.
13. The hardening processing apparatus as set forth in claim 7, wherein  
the coating film is an insulating film, and the heating processing is  
15 low oxygen heating processing of heating the substrate in a low oxygen  
atmosphere to cause condensation polymerization reaction of the coating film  
to thereby chemically harden the coating film.
14. The hardening processing apparatus as set forth in claim 8, wherein  
20 the coating film is an insulating film, and said second irradiation unit  
irradiates the substrate with the ultraviolet light to thereby perform quality  
improving processing of the insulating film.
15. The hardening processing apparatus as set forth in claim 1, wherein  
25 said heating plate is movable up and down.

16. The hardening processing apparatus as set forth in claim 15, further comprising:

a sensor for judging deterioration of said first irradiation unit in said first processing chamber; and

5 a controller for raising said heating plate based on a signal from said sensor.

17. The hardening processing apparatus as set forth in claim 1, wherein said first irradiation unit is capable of applying ultraviolet lights  
10 having two different wavelengths, and said first irradiation unit is movable between said first processing chamber and said second processing chamber.

18. A coating film forming apparatus for forming a coating film on a substrate, comprising:

15 a coating unit for coating the substrate with a coating solution;

a hardening processing apparatus for hardening the coating solution on the substrate coated with the coating solution in said coating unit; and

a carrier unit for carrying the substrate between said coating unit and said hardening processing apparatus,

20 wherein said hardening processing apparatus comprises:

a first processing chamber for mounting the substrate coated with the coating solution on a heating plate and heating the substrate to a predetermined temperature on a one-by-one basis;

a first irradiation unit provided in said first processing chamber, for  
25 irradiating the substrate mounted on said heating plate with ultraviolet light; and

a second processing chamber connected in a communicating manner to said first processing chamber, for mounting the substrate coated with the coating solution on a temperature adjusting plate and adjusting the substrate to a temperature lower than a processing temperature of hardening processing on a one-by-one basis.

19. A hardening processing method for hardening a coating film on a substrate, comprising:

a heating processing step of mounting the substrate coated with a coating solution on a heating plate and heating the substrate to a first temperature on a one-by-one basis; and then

a hardening processing step of subsequently heating on a one-by-one basis the substrate for which the heating processing has been performed, kept mounted on the heating plate, to a temperature of the hardening processing that is higher than the first temperature, and irradiating the substrate with ultraviolet light having a predetermined wavelength to harden the coating film on the substrate.

20. A hardening processing method for hardening a coating film on a substrate, comprising:

a heating processing step of mounting the substrate coated with a coating solution on a temperature adjusting plate and heating the substrate to a first temperature on a one-by-one basis; and then

a hardening processing step of positioning the temperature adjusting plate, on which the substrate for which the heating processing has been performed is mounted, above a heating plate, raising a raising and lowering

mechanism from the heating plate for the raising and lowering mechanism to receive the substrate on the temperature adjusting plate, then moving the temperature adjusting plate to an outside of the heating plate, and thereafter lowering the raising and lowering mechanism to thereby transfer the substrate  
5 from the temperature adjusting plate to the heating plate, heating on a one-by-one basis the substrate to a temperature of the hardening processing that is higher than the first temperature, and irradiating the substrate with ultraviolet light having a predetermined wavelength to harden the coating film on the substrate.

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21. The hardening processing method as set forth in claim 19, further comprising:

a quality improving step, performed after said hardening processing step, of irradiating the substrate with the hardened coating film, with  
15 ultraviolet light having a wavelength different from that of the hardening processing of the coating film to improve the quality of the coating film.

22. The hardening processing method as set forth in claim 20, further comprising:

20 a quality improving step, performed after said hardening processing step, of irradiating the substrate with the hardened coating film, with ultraviolet light having a wavelength different from that of the hardening processing of the coating film to improve the quality of the coating film.